

भारतीय मानक

प्राकृतिक निर्माण पत्थरों के सामर्थ्य गुणों को  
ज्ञात करना — परीक्षण पद्धतियाँ

भाग 2 अनुप्रस्थ सामर्थ्य

( दूसरा पुनरीक्षण )

*Indian Standard*

DETERMINATION OF STRENGTH PROPERTIES OF  
NATURAL BUILDING STONES — METHODS OF TEST

PART 2 TRANSVERSE STRENGTH

( *Second Revision* )

ICS 91.100.15

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BUREAU OF INDIAN STANDARDS  
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NEW DELHI 110002

## FOREWORD

This Indian Standard (Part 2) (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Stones Sectional Committee had been approved by the Civil Engineering Division Council.

Building stones are available in large quantity in various parts of the country and to choose and utilize them for their satisfactory performance, it is necessary to know the various strength properties determined according to standard procedure. This standard has, therefore, been formulated to cover the standard method for determining the strength properties of various stones. This standard covering compressive, transverse and shear strength properties was published in 1957 and was subsequently revised in 1974 where property of tensile strength was also added as the same was also important for assessing the suitability of stone; the revision was issued in four parts. Other parts are:

- Part 1 Compressive strength
- Part 3 Tensile strength
- Part 4 Shear strength

This standard is brought out to incorporate the experience gained based on the use of the standard since its last revision. The major modifications incorporated in the revision are as follows:

- a) SI units have been used,
- b) Size of the samples has been specified as ‘stones of adequate size’ in place of the requirement of at least 25 kg specified earlier,
- c) Surface finishing requirement of specimen has been modified by making reference to IS 9179 : 1979 ‘Method for preparation of rock specimen for laboratory testing’,
- d) Vacuum saturation in water has been specified for conditioning of the test specimens in place of normal immersion,
- e) Rate of loading has been modified in line with IS 9143 : 1979 ‘Method for the determination of unconfined compressive strength of rock materials’,
- f) The word ‘rift’ has been replaced with ‘plane of anisotropy’, and
- g) The minimum number of test specimen has been revised from three to five for test for each of the set of conditions.

The composition of the technical committee responsible for the formulation of this standard is given in Annex A.

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’.

*Indian Standard***DETERMINATION OF STRENGTH PROPERTIES OF  
NATURAL BUILDING STONES — METHODS OF TEST****PART 2 TRANSVERSE STRENGTH***( Second Revision )***1 SCOPE**

This standard (Part 2) lays down the procedure for determination of transverse strength of natural building stones used for constructional purposes.

**2 REFERENCE**

The standard listed below contains provision which through reference in this text, constitutes provision of this standard. At the time of publication, the edition indicated was valid. All standards are subject to revision and parties to agreements based on this standard is encouraged to investigate the possibility of applying the most recent edition of the standard indicated below:

| <i>IS No.</i>  | <i>Title</i>   |
|----------------|--|
| IS 9179 : 1979 | Method for preparation of rock specimen for laboratory testing |

**3 SELECTION OF SAMPLES**

**3.1** The sample shall be selected to represent a true average of the type or grade of stone under consideration.

**3.2** The sample shall be selected from the quarried stone or taken from the natural rock, as described in **3.2.1** and **3.2.2** and shall be of adequate size to permit the preparation of the requisite number of test specimens.

**3.2.1 Stones from Ledges or Quarries**

The ledge or quarry face of the stone shall be inspected to determine any variation in different strata. Differences in colour, texture and structure shall be observed. Separate samples of stone of adequate size of the unweathered specimens shall be obtained from all strata that appear to vary in colour, texture and structure. Specimens that have been damaged by blasting, driving wedges, heating, etc, shall not be included in the sample.

**3.2.2 Field Stone and Boulders**

A detailed inspection of the stone and boulders over the area shall be made where the supply is to be

obtained. The different kinds of stones and their conditions at various quarry sites shall be recorded. Separate samples for each class of stone that would be considered for use in construction as indicated by visual inspection shall be selected.

**3.3** When perceptible variations occur in the quality of rock, as many samples as are necessary for determining the range in properties shall be selected.

**4 TEST SPECIMENS AND CONDITIONING**

**4.1** Test specimens shall be made from samples selected in accordance with **3** and shall be blocks of size 200 mm × 50 mm × 50 mm. The test specimens shall be measured at the centre section. The width shall be measured to the nearest 0.2 mm and the thickness shall be taken as the average of three measurements to the nearest 0.2 mm, one taken at centre and the other two near edges.

**4.2** The load-bearing surfaces shall be prepared in accordance with IS 9179.

**4.3** The direction of the plane of anisotropy shall be carefully marked on each test specimen after finishing.

**4.4** Five test specimens shall be used for conducting the test in each of the conditions mentioned in **4.4.1** and **4.4.2** separately.

**4.4.1** The test specimens shall be saturated by vacuum saturation by immersing in water maintained at 20 °C to 30 °C in an evacuation vessel under a vacuum of about 50 mm of Hg to 100 mm of Hg. Specimens shall be initially immersed continuously for about 4 to 5 h in vacuum and then its mass is measured at an interval of 1 h (sample being replaced back in evacuation vessel after weighing) till constant mass. Constant mass is considered to have achieved when two consecutive hourly measurement of mass do not vary by more than 0.1 percent of the saturated mass. Vacuum may be created by a suitable air suction pump.

**4.4.2** The test specimens shall also be tested in a dry condition and shall be dried in an oven at 70 ±

5 °C for 48 h and cooled in a desiccator to room temperature (20 °C to 30 °C). Constant mass is considered to have been achieved when two consecutive hourly measurements of mass do not vary by more than 0.1 percent.

## **5 APPARATUS**

A suitable form of apparatus is shown in Fig. 1.

## **6 PROCEDURE**

**6.1** Each test specimen to be tested shall be evenly supported upon two self-aligning bearers (*A* and *B* in Fig. 1) 40 mm in diameter, the distance between the centres of bearers being 150 mm. Bearer *A* is supported horizontally on two bearer screws (*C* in Fig. 1), which carry hardened steel balls (*D* in Fig. 1) concentric with the bearer. Bearer *B* is supported on one such bearer screw and ball.

**6.2** The load shall then be applied centrally at a uniform rate of 20 N/min through a third bearer (*E* in Fig. 1), also 40 mm in diameter, placed midway between the supports upon the upper surface of the specimen (see Fig. 1) and parallel to the supports. The length of all bearers shall exceed the maximum width of the specimen to be tested.

## **7 EVALUATION AND REPORT OF TEST RESULTS**

**7.1** The transverse strength of the specimen tested shall be calculated as follows:

$$R = \frac{3 WL}{2 bd^2}$$

where

- R* = transverse strength, in N/mm<sup>2</sup>;
- W* = central breaking load, in N;
- L* = length of span, in mm;
- b* = average width in mm of the test specimen at the mid section; and
- d* = average depth in mm of the test specimen at the mid section.

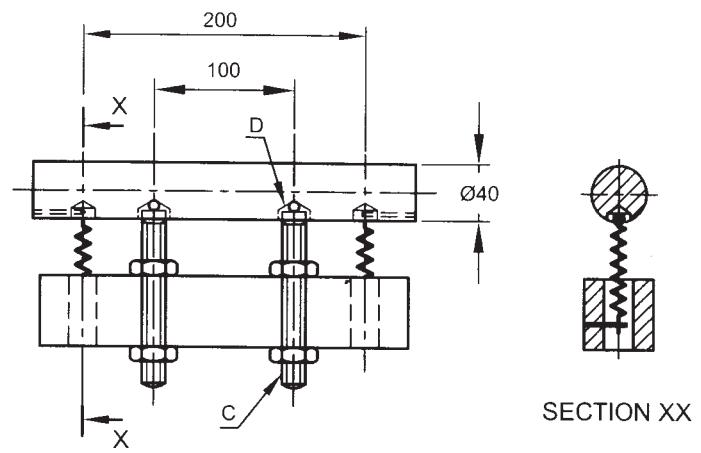
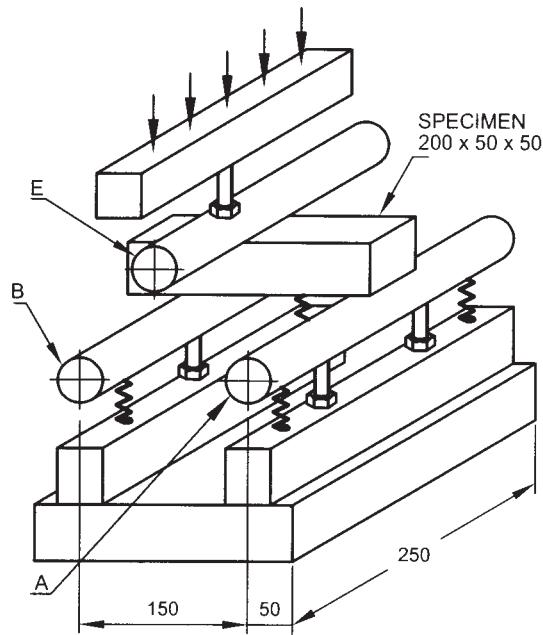
**7.2** The average of all the five results (separately for saturated and dry condition) shall be taken for the purpose of determining transverse strength of the sample.

**7.3** The average of the five results in each condition separately (see 4.4) shall be taken for purposes of reporting the transverse strength of the sample provided the individual variation is not more than ±15 percent of the average. Otherwise repeat tests shall be made.

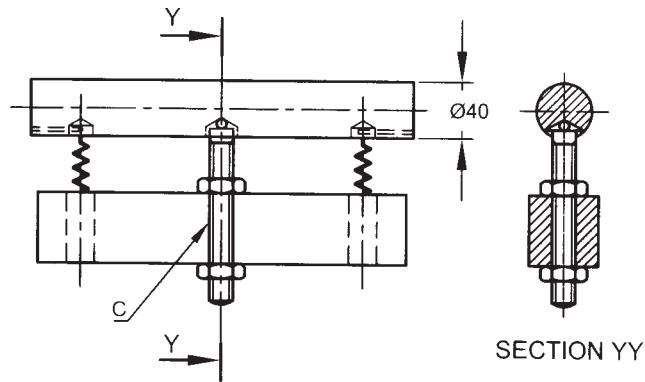
**7.4** The transverse strength of the sample shall be expressed in N/mm<sup>2</sup>.

**7.5** Identification of the sample, date when the sample was taken and type of stone shall be reported.

**7.6** The size and shape of the test specimen used in the test shall be indicated.



ENLARGED DETAIL OF BEARER 'A'



SECTION YY

ENLARGED DETAIL OF BEARER 'B'

All dimensions in millimetres.

FIG. 1 APPARATUS FOR DETERMINATION OF TRANSVERSE STRENGTH

**ANNEXA**  
*(Foreword)*

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This Indian Standard has been developed from Doc No. : CED 6 (7719).

## **Amendments Issued Since Publication**

| Amendment No. | Date of Issue | Text Affected |
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